FARMERS RURAL ELECTRIC COOPERATIVE CORPORATION
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JACKIE B. BROWNING, PRESIDENT AND CEO

October 17, 2003

Mr. Thomas M. Dorman, Executive Director
Kentucky Public Service Commission
P.O. Box 615
Frankfort, Kentucky 40602

RE: Case No. 2003-00298

Dear Mr. Dorman:

Please find enclosed the original and five (5) copies of Farmers Rural Electric Cooperative Corporation's response to the Commission's Order in Case No. 2003-00298 dated October 6, 2003.

If you have any question or need additional information, please advise.

Sincerely,

Jackie B. Browning
President & CEO

Enclosures

INDEX

Item 1a. Provide two copies the voltage drop study based upon existing loads using existing system circuitry.

Contact Person: Tony Wells

The two copies of the voltage drop study based upon existing loads using existing system circuitry are submitted with this document.

Item 1b. Provide two copies the voltage drop study based upon projected loads using existing system circuitry.

Contact Person: Tony Wells

The two copies of the voltage drop study based upon projected loads using existing system circuitry are submitted with this document.

Item 1c. Provide two copies the voltage drop study based upon projected loads using proposed system circuitry.

Contact Person: Tony Wells

The two copies of the voltage drop study based upon projected loads using proposed system circuitry are submitted with this document.

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2a. Provide Automated Meter Report Cost Justification Study to confirm that Automated Meter Reading is the most economical and efficient method of reading customer meters.

Contact Person: Jerry W. Carter

The Automated Meter Report Cost Justification Study is enclosed under this tab.

TWO-WAY AUTOMATIC COMMUNICATION SYSTEM
FOR
FARMERS RURAL ELECTRIC COOPERATIVE CORPORATION

Purpose

The purpose of Farmers Rural Electric Cooperative Corporation's implementation of DCSI's Two-Way Automatic Communication System (TWACS) is to effectively acquire meter readings for residential and small commercial accounts by utilizing two-way power line communication technology for Automatic Meter Reading (AMR), load control, and other value-added services.

Background

DCSI has marketed and manufactured TWACS two-way power line communication technology since 1978. TWACS works by modulating the voltage waveform at the zero-crossing point as part of the AC waveform. Because of this there is neither a need for repeaters, blocking devices nor any conditioning or special maintenance of FRECC's distribution feeders for TWACS to operate reliably. Based on current research, TWACS technology delivers over 99% message reliability.

Scope

The TWACS system reduces meter reading costs in a variety of ways. TWACS improves customer service and reduces intrusions on customers. The fully automated remote billing reads provided by TWACS remove the meter reading responsibility from the consumer and place the responsibility on FRECC; thus, providing a value-added service for consumers and providing accurate, dependable reads for FRECC. The system eliminates estimated readings and billings for those accounts for which a monthly reading is not received. On-request reads for high bill complaints or other consumer issues can be completed in seconds providing value for the consumer and FRECC, while boosting consumer confidence. Reads for final billing of an account may be taken through a virtual disconnect reading rather than waiting for a card to be sent to physically collect the final reading.

The system is very consumer-friendly by providing detailed information about each account. It provides the potential for summary billing of multiple meters for a single account. Due to the ease and availability of information, multiple billing cycles may be offered allowing consumers to be billed on a date of their selection. As a result, goodwill is increased due to the perception of the utility's focus on high-quality customer service. Further enhancing customer service in the future, a Time-of-Use rate may be offered to consumers through the utilization of the TWACS data.

TWACS records outage counts to monitor service reliability, even when the outage is just a "blink" on the system. In a multiple outage situation, by pinging each meter in an area of a suspected outage, the system will determine all meters out of service. This feature allows for a more efficient response in an outage situation.

The TWACS system provides the technology to detect meter tampering and energy theft, reducing the costs associated with each. It is estimated that the loss associated with tampering and energy theft for FRECC would be approximately $88,000 per year.

The information provided by the remote retrieval of power quality, engineering, and planning data from electronic meters will aid in the development of future work plans for FRECC.

The Integrated Metering Transponder component of the TWACS system allows for the potential to create new revenue through the reading of gas and water meters both monthly and on-request.

Product Description

Integrated Metering Transponder

Installed under the glass in the residential meter, the IMT provides remote access to electrical consumption, demand, and related billing information in the residential setting. The TWACS network retrieves data directly from an individual IMT or a group of IMT's through the use of the two-way communication feature. Each IMT includes built-in peak measurement with remote reset and an autonomous self-read feature to support load surveying functions. Through the utilization of non-volatile storage within the IMT, optional advanced metering functions are possible such as Time-Of-Use, Real-Time Pricing, and Interval Data Recording. For an additional cost than the basic IMT, a three-port configuration is available, allowing for metering water or gas meters in addition to the integral watt-hour meter.

The optional three-port IMT includes two auxiliary ports to accept meter reading from water and gas meters. A hardwired connection to a dial encoder or pulse initiator enables the complete meter reading function to be accomplished with no batteries. Water and gas meters with dial encoder or pulse initiator features are directly compatible with the three-port IMT. During an extended power outage, pulse saver circuitry is used to accumulate and store pulse data.

Installation of the basic IMT into the system is accomplished by installing the device into the meter socket under the glass. Existing system meters may be retrofit to assist in lowering the cost of implementing the AMR system. User commands issued from FRECC's offices retrieve instantaneous accurate metering data from the IMT. Data from the entire FRECC system may be collected in simply an hour or two.

Individual on-request reads are obtained directly from the meter in approximately 10 seconds for speed in dealing with customer telephone inquiries, initial or final billings, or any other special read purpose.

IMT's may be grouped together for simultaneous readings using a flexible addressing scheme. Groups can be formed and altered when necessary. A broadcast mode permits parameters to be sent to all, or a specified portion, of the meter population within seconds.

The IMT identifies energy theft by the detection of events such as reverse power flow (flipping the meter upside down), zero energy flow for a prescribed period, and a disconnection of a hardwired input on an auxiliary port. Such events create a tamper flag in the system. Tamper indications are reported as an alarm during subsequent system communication transactions. The IMT measures the amount of reverse power flow to assist in revenue recovery.

The individual IMT's keep a count of the number of power outages or "blinks". These counts provide a direct measurement of service reliability at each location. A comparison of counts between IMT's served from the same feeder segment or distribution transformer to detect meter removals or tampering.

The virtual disconnect capability of the system verifies that an account is inactive by performing remotely programmable periodic readings of the standard IMT and checking for usage levels beyond a programmable threshold.

Substation Communications Equipment

The Substation Communication Equipment (SCE) is the interface between the Central Control Equipment (CCE) and the remote IMT's in the TWACS power line network. The SCE is comprised of communications and power equipment located in the distribution substation. The SCE receives commands from the Central Control Equipment, translates the commands to TWACS format, and couples them to the utility power network for transmission to the IMT's. The SCE then decodes the IMT response messages for transmission back to the CCE. The SCE autonomously performs TWACS network management functions, such as determining electrical path data for each IMT and synchronizing the date/time for all IMT's.

Each SCE is a stand-alone communications hub, capable of independently and simultaneously executing commands, receiving data, and transmitting results back to the CCE. There is no limit to the number of remote IMT's that may be accessed from a single SCE. The SCE uses CRC error detection and Hamming error correction algorithms to ensure data integrity. SCE and CCE communications are through a standard voice-grade communications link, carried on a variety of physical media, radio in FRECC's case.

The Substation Communications Equipment is comprised of two units, the Outbound Modulation Unit (OMU) and the Control and Receiving Unit (CRU). The OMU produces the TWACS outbound message from the substation to the IMT which commands an IMT to respond with remotely acquired data, take a control action, or download an internal parameter. The outbound signal is coupled to the substation bus through a distribution transformer, referred to as a Modulation Transformer Unit. The Control and Receiving Unit component receives the inbound data from one or more IMT's, verifies the integrity of the data, performs any necessary communication retries and returns the data to the Central Control Equipment. The inbound signal is coupled to the CRU through an Inbound Pickup Unit (IPU) inserted in the existing metering or protection CT circuit. The CRU is responsible for all communication between the substation and the CCE. Each substation requires one CRU and as many OMU's as there are independent busses.

SCE components may be used indoors or outdoors. Enclosures are highly resistant to the effects of precipitation, high humidity, solar load/UV and a corrosive atmosphere. They can withstand ground potential rises and switching transients. The components contain surge protection to ensure equipment reliability and are interconnected using fiber optic cables for survivability in the utility substation environment.

TWACS Net Server

The TWACS Net Server is the Central Control Equipment for the TWACS network. The TWACS Net Server (TNS) carries out two primary functions: management of the TWACS communication network and remote data collection into the relational database server. The TNS appears to the utility client workstations and other data systems as a node on the utility's enterprise LAN/WAN. The industry-standard relational database, Oracle, provides ease of interaction and inter-operation with other network applications. The Windows NT operating system is used on the server platform components.

Personnel within the utility interact with the TWACS Net Server using their existing PC-class workstations by accessing the TNS over FRECC's network. Access can be extended beyond FRECC through either dial-up networking or use of FRECC's Intranet. This function would be useful where FRECC may provide water or gas AMR, or other services, to external entities. Firewall protection is the responsibility of FRECC, but the Oracle database and Windows NT contain numerous access authority primitives and other protection primitives upon which utility defined restrictions can be constructed.

Implementation

The implementation of the TWACS network in the FRECC distribution system will take place over a three-year period. Four substations will be outfitted annually involving approximately 7,350 meters per year.

Associated Costs of Doing Business Before TWACS

Year	1	2	3	4	5	6	7	8	9	10
902 acct analysis-5% annual avg increase in $'s	$101,154	$106,212	$111,522	$117,098	$122,953	$129,101	$135,556	$142,334	$149,451	$156,923
Disc/connect field trips-5.3% annual avg increase in #'s-3% labor inf.										
2001-discs/recs-3326-.5/hr @ $34.65/hr-50% ratio	$28,811	$31,249	$33,883	$35,588	$38,600	$40,552	$42,611	$44,762	$47,028	$49,403
Loss of one months cash flow @ 4%	$80,000	$82,400	$84,048	$85,729	$87,443	$89,192	$90,976	$92,796	$94,652	$96,545
Billing adjustment-labor only-340adjs/mo @ 10min/ea @$21.75/hr	$15,000	$15,545	$16,333	$17,154	$18,209	$19,110	$20,100	$21,137	$22,216	$23,346
Billing problems-customers calling in about over/under ests-2-employees	$90,480	$95,004	$99,754	$104,741	$109,694	$115,179	$120,938	$126,985	$133,334	$140,000
Consumer problems-blinks-low voltage etc.-7/mo @$170 ea	$14,280	$14,994	$15,120	$17,154	$18,368	$18,919	$19,486	$22,580	$23,257	$23,954
Data entry of consumer reads-40%of 1 employees time	$18,100	$19,005	$19,955	$20,962	$22,000	$23,100	$24,255	$25,468	$26,741	$28,078
Inefficiencies in work planning-estimate 4% growth	$10,000	$10,400	$10,816	$11,249	$11,699	$12,167	$12,653	$13,159	$13,686	$14,233
Outage and Restoration call backs to same outage-estimate-4% growth	$2,000	$2,080	$2,163	$2,250	$2,340	$2,433	$2,531	$2,632	$2,737	$2,847
Customer problems-main breaker-130/yr-53%-rt & 47%-ot-bundled costs										
Regular time-$34.65/hr-includes truck-69 calls	$2,390	$2,509	$2,573	$2,726	$2,847	$3,013	$3,186	$3,367	$3,556	$3,753
Overtime-$95.27/hr-2-men & trucks-2hr/ea-61 calls-$190.54/call	$11,623	$11,971	$12,330	$13,324	$13,938	$14,577	$15,241	$15,932	$16,651	$17,398
Bad debt chargeoffs minus revenue recovered-.35% of revenue	$45,773	$50,233	$55,055	$60,341	$66,023	$72,482	$79,440	$87,066	$95,425	$104,585
Tampering-.5% of residential revenue-does not include labor	$88,000	$89,250	$91,035	$92,856	$94,713	$96,607	$98,539	$100,510	$102,520	$104,571
Hand held maintanence @ 3%/yr	$2,000	$2,060	$2,122	$2,185	$2,251	$2,319	$2,388	$2,460	$2,534	$2,610
Total Cost of Meter Reading	$509,611	$532,912	$556,709	$583,357	$611,078	$638,750	$667,900	$701,188	$733,787	$768,245

Associated Costs With TWACS

Year	1	2	3	4	5	6	7	8	9	10
Meter dept employee	$40,000	$41,200	$42,436	$43,709	$45,020	$46,371	$47,762	$49,195	$50,671	$52,191
Billing problems-sustomers inquiring about their electric bills	$90,480	$77,780	$65,080	$52,370	$53,941	$55,559	$57,226	$58,943	$60,711	$62,533
Bad debt chargeoffs-2/3 of present	$38,000	$44,707	$42,943	$40,428	$44,235	$48,563	$53,224	$58,334	$68,688	$70,072
Principal and interest of TWACS loan	$205,168	$475,320	$935,076	$1,210,848	$1,210,848					
Service contract	included	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000	$15,000
Additional 710 meters for growth		$57,882	$57,882	$57,882	$57,882	$57,882	$57,882	$57,882	$57,882	$57,882
Meter tampering	$88,000	$58,080	$29,040	$9,583	$0	$0	$0	$0	$0	$0
Total Associated Costs of TWACS Meter Reading	$461,648	$769,969	$1,187,457	$1,429,820	$1,426,926	$223,375	$231,094	$239,354	$252,952	$257,678

Parameters

TWACS Quote from TVESCO	$2,055,318.47
6% sales tax	$123,319.10
Modulation Transformers including labor	$228,000.00
Labor (meter retrofits, etc.)	$192,000.00
Radio Communication to substations	$120,000.00
Total installed cost of TWACS	$2,718,637.57
Installed at 1/3,1/3,1/3 per year	$906,212.52

Cost Benefit Analysis

Year	1	2	3	4	5	6	7	8	9	10
Installed cost of meters	$1,367,860	$1,676,181	$2,093,669	$1,429,820	$1,426,926	$223,375	$231,094	$239,354	$252,952	$257,678
RUS Loan Proceeds	$906,212	$906,212	$906,212							
Estimated Savings with TWACS	$509,611	$532,912	$556,709	$583,357	$611,078	$638,750	$667,900	$701,188	$733,787	$768,245
Total of Loan Proceeds and Savings	$1,415,823	$1,439,124	$1,462,921	$583,357	$611,078	$638,750	$667,900	$701,188	$733,787	$768,245
Estimated Return	$47,963	($237,057)	($630,748)	($846,463)	($815,848)	$415,375	$436,806	$461,834	$480,835	$510,567

Item 2b. Does the AMR report outages and/or voltages back to your office? If no, explain why those features are not included.

Contact Person: Tony Wells

No. The field unit does not report to the office. The software in the office can interrogate the field unit. During this interrogation the status and voltage can be obtained.

Item 2c. Does the AMR cost justification include an outage tracking and reporting package? If no, explain why those features are not included.

Contact Person: Tony Wells

No. The primary function of the system is to read meters. The system, by nature of having a communication path to the meter and the ability to obtain the voltage, can determine the status of a location. By interrogating a group of field units, it can also be determined the area of an outage.

Item 3a. Provide the date of each reading in the Voltage Comparison..

Contact Person: Tony Wells

The updated "Voltage Comparison" is enclosed under this tab.

Voltage Comparison

Date	Demand	Location	Recorder Voltage	Line Section	Milsoft Voltage	Diif.	
2/21/2001	71867	43-69-036	123.3	4340901	122.3	-1	
		45-65-043	123.6	4531101	121.8	-1.8	
		38-33-022	123	3811501	125.8	2.8	system config changed
		01-73-046	123	131301	125.4	2.4	
2/27/2001	71604	44-14-023	124.8	4410501	125.3	0.5	
		38-63-073	126.3	3831001	126	-0.3	
		43-48-033	124.2	4321202	123.4	-0.8	
		36-66-034	122.7	3641201	124	1.3	
3/15/2001	62459	44-42-019	125.1	4430101	123.4	-1.7	
		38-42-032	123.3	3812501	124.9	1.6	
		43-59-060	125.1	4340801	124.7	-0.4	
		31-65-030	123.5	3130902	124.8	1.3	
3/29/2001	63621	44-24-017	125.1	4410801	125	-0.1	
		38-34-032	123.6	3812202	125.5	1.9	
		48-69-073	122.8	4841201	123.9	1.1	
		31-63-047	123.6	3131002	125.1	1.5	
4/5/2001	54101	44-44-023	124.5	4411002	125.1	0.6	
		38-43-031	124.5	3811901	125.2	0.7	
		31-82-020	124.8	3131403	124.8	0	
4/11/2001	57977	44-28-058	126	4420701	126	0	
		31-84-012	123.9	3131501	124.5	0.6	
		32-43-006	121.8	3210501	124.6	2.8	regulator malfunction
		07-66-016	122.5	740501	123.8	1.3	
4/26/2001	58662	43-88-166	122.5	4342901	124.1	1.6	
		44-48-027	126	4421502	126	0	
		38-67-041	122.7	3740701	125.4	2.7	
		37-89-011	124.2	3741302	125.4	1.2	
5/1/2001	55359	48-76-068	124.8	4840802	125.2	0.4	
		37-35-018	125.7	3710501	125.2	-0.5	
5/15/2001	64452	45-32-023	126	4511301	125.7	-0.3	
		36-58-044	123	3640702	124.4	1.4	
		07-35-039	123.6	711901	122.3	-1.3	
		26-62-022	120.5	2630101	122.7	2.2	
5/22/2001	52752	44-36-050	123.2	4421601	125.2	2	
		38-88-080	124.2	3842101	125	0.8	
		31-68-040	125.4	3141101	125.3	-0.1	
		07-49-027	123.9	721801	124	0.1	
6/7/2001	61972	43-64-077	124.2	4331001	121.7	-2.5	
		38-82-027	124.5	3831501	125.8	1.3	

		31-24-025	123.2	3110602	125.4	2.2	
6/21/2001	71369	38-66-060	122.4	3840902	124.9	2.5	
		48-87-055	118.8	4842201	121.8	3	
		02-76-057	121.8	240502	126	4.2	regulator malfunction
		37-38-051	119.4	3721301	120.3	0.9	
7/1/2001	62333	45-58-008	123.3	4540502	122.7	-0.6	
		48-65-043	122.2	4831301	124.8	2.6	
		38-87-024	124.5	3841801	122.5	-2	
7/11/2001	82522	38-26-022	120.3	3820902	121.2	0.9	
		06-64-050	121.8	630501	120.8	-1	
		36-45-034	119.2	3611201	123.1	3.9	regulator malfunction
7/17/2001	82894	44-97-042	122.7	4441701	124.7	2	
		38-16-044	120.9	3811002	121.2	0.3	
		37-15-037	124.2	3131701	125.4	1.2	
8/7/2001	89220	39-72-055	122.1	3930302	119.7	-2.4	
		08-15-018	121	820101	123.3	2.3	
9/5/2001	79741	02-69-029	116.5	240201	121.5	5	
		01-89-108	124.5	141701	125.9	1.4	
		37-73-144	124.8	3731002	124.9	0.1	
		25-74-056	123.3	2530302	122.5	-0.8	
9/17/2001	58816	42-39-022	123	4220202	124.4	1.4	
		02-11-001	119.8	120602	120.8	1	
		01-57-027	122.7	140301	124.8	2.1	
		02-09-052	125.1	220402	126	0.9	
9/25/2001	54739	02-53-031	125.7	230402	125.4	-0.3	
		02-13-035	119.7	210701	120.6	0.9	
		01-52-043	124.2	130101	124.7	0.5	
10/17/2001	69677	02-28-028	122.5	220702	124.6	2.1	
		02-94-024	124.2	232301	124.1	-0.1	
		07-29-020	123.9	721401	125.3	1.4	
		08-24-030	123.3	811001	124.8	1.5	

Item 3b. Explain how Farmers arrived at the milsoft voltages..

Contact Person: Tony Wells

The Milsoft voltages were obtained by knowing the date and time of the voltage reading. The date and time were used to obtain the system demand. The system demand was then utilized in the Milsoft models to obtain the voltage to compare with the recorder voltage readings.